

FINAL STORM WATER DRAINAGE REPORT

LOT 1C

DOUGLAS CORNER

LEE'S SUMMIT, MISSOURI

150 NE TUDOR ROAD

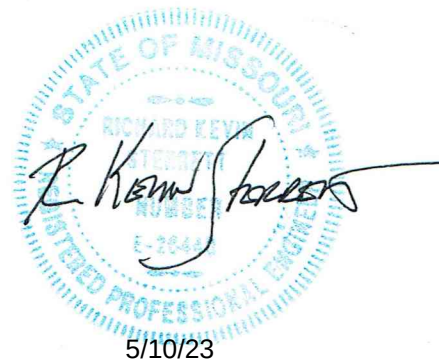
PREPARED FOR

CAPITAL BUILDERS,LLC

PREPARED BY

HG CONSULT, INC.

MAY 10th, 2023



5/10/23

TABLE OF CONTENTS

1. Cover Sheet
2. Table of Contents
3. Project Overview
4. Drainage Assessment of the Project Site
5. Conveyance Design
6. Temporary Erosion and Sediment Control
7. Design Calculations
8. Exhibits
 - Predevelopment Drainage Map
 - Post Development Drainage Map
 - Pond Pack Calculations
 - Pipe Calculations
 - Lee's Summit Checklist

3. Project Overview

The proposed project is a speculative retail building. The building will be contained in a 7,972 square foot building footprint. This project is contained on a 1.73 acre site. The site is construction ready. The storm sewer system and detention pond will need additional improvements to allow for proper drainage from site.

The topography of the site is a gentle slope west to the east. The existing storm sewer detention system is in place on the east side of the site on the east side of NE Douglas Street and the north side of Tudor Road. The overall existing storm sewer system serves all of Douglas Corners. An additional amount of detention will be required to accommodate the entire developed area which is provided with this project.

4. Drainage Assessment of the Project Site

Due to the slope of the site and the need for a flat slab, the bench and fill grading method was used for the site along with the need to have positive drainage away from the building, drainage areas directing storm water into new storm sewer catchments that forces storm water into the detention pond. The remainder of the site grading directs pervious areas and impervious areas away from the building and drainage to the proposed detention pond. Design requirements call for a piping system with a minimum capacity for the 10 year event, with the 100 year storm event being routed overland in an above grade manner such as swales and gutters. To insure that higher frequency storms would not cause any ponding problems or inundation of parked vehicles, the structures and piping system have been designed to the 100 year event flows. With the relatively small drainage areas, these flows are low and pipe sizes are 15 inch draining to the detention pond and an existing 18" discharge pipe from the detention pond to an existing catch basin off-site.

5. Conveyance Design

As shown on the Drainage plan for the site, all areas drain to the detention pond by sheet flow over the parking and drive aisle area and by existing piping system. This system generates a 10 year flow of 34.98 cfs and a 100 year flow of 57.94 cfs pre-developed. After development and routing through the detention pond, 10 year flows have been reduced to 13.60 cfs and 100 year flows have been reduced to 16.56 cfs.

6. Temporary Erosion and Sediment Control

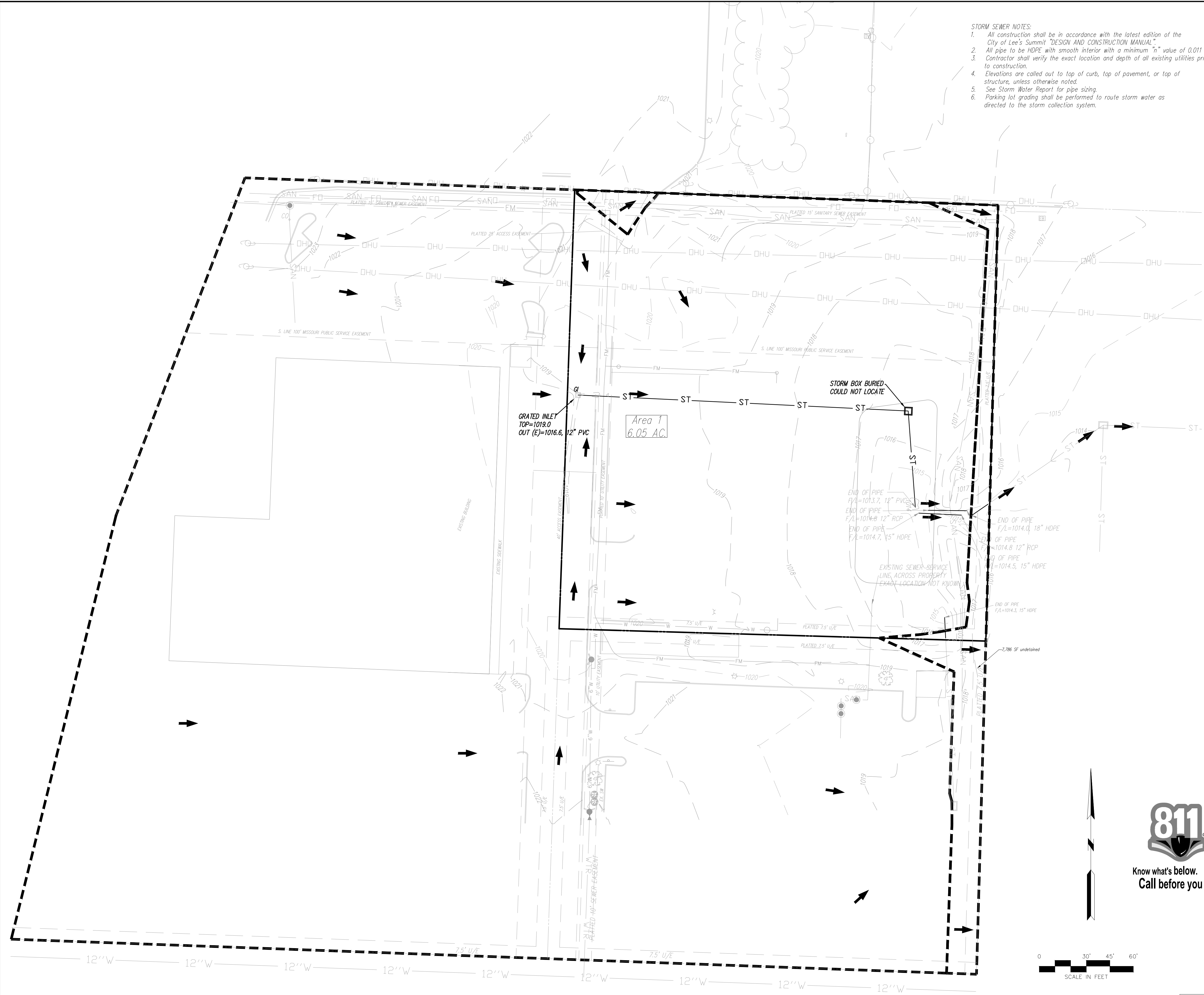
During construction and prior to paving, it will be necessary to control erosion and sediment from the site during storms within the construction timeframe. To insure that sediment does not enter the existing storm system or runs off to the existing street, perimeter containment is controlled by silt fence installation, inlet protection and an engineered detention release structure. To keep construction traffic from tracking mud onto the adjacent city street, a stabilized rock construction entrance will need to be installed. These erosion control devices, and their maintenance throughout the construction timeframe, are required by ordinance and the details for them are referenced by the City's Design and Construction Manual and shown on Detail Sheets 10 thru 13.

Post development water quality will be addressed through the use a filtering device prior to storm water discharge into pond in lieu of the standard method of routing through the pond with extended release, due to volume considerations within the pond. The owner will need to have a routine maintenance policy for the cleaning, repair and replacement of the filters within the structures.

7.Design Calculations

See the attached for drainage area calculations, detention calculations, flows, pipe sizing, water quality calculations as requested.

8.Exhibits



- STORM SEWER NOTES:
1. All construction shall be in accordance with the latest edition of the City of Lee's Summit "DESIGN AND CONSTRUCTION MANUAL".
 2. All pipe to be HDPE with smooth interior with a minimum "n" value of 0.011.
 3. Contractor shall verify the exact location and depth of all existing utilities prior to construction.
 4. Elevations are called out to top of curb, top of pavement, or top of structure, unless otherwise noted.
 5. See Storm Water Report for pipe sizing.
 6. Parking lot grading shall be performed to route storm water as directed to the storm collection system.

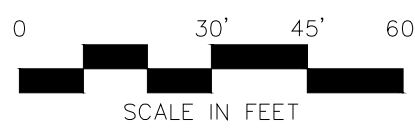
Contractor to verify all invert elevations for existing sewer connections. Contact civil engineer if conflict arises.

PROJECT BENCHMARK:

- #1 Iron bar at north west corner of property.
N 1006947.3760
E 2823375.6230
TOP ELEV. 1021.42
- #2 Top of curb at corner of parking lot in Schlotsky's parking.
N 1006628.2690
E 2823596.0320
TOP ELEV. 1019.80



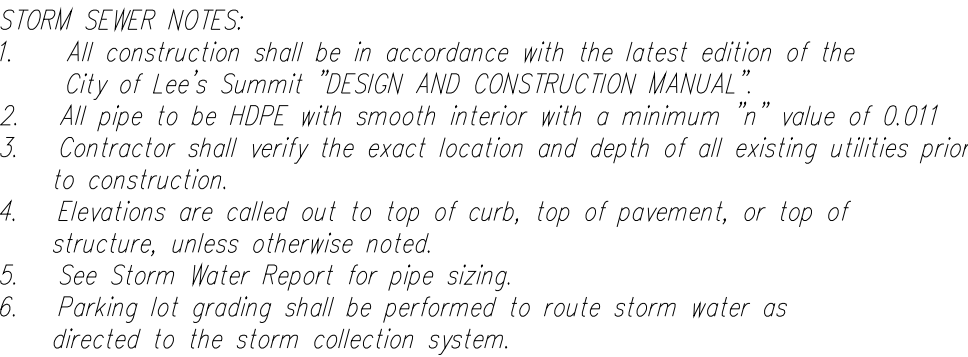
Know what's below.
Call before you dig.



PROPOSED	KEY	EXISTING
979	Grades	960
→	100 Year Overflow	
- - -	Drainage Area	

Contractor to verify all invert elevations for existing sewer connections. Contact civil engineer if conflict arises.

PRELIMINARY DEVELOPMENT DRAINAGE AREA MAP	DOUGLAS CORNER BUILDING LEE'S SUMMIT - JACKSON COUNTY - MISSOURI	DATE	REVISION	BY	CHKAPP
		NO.			
May 10, 2023 Consult Inc engineers planners 1533 Locust Street, Kansas City, Missouri 64108 CORPORATE LICENSE No. E201000573 (MO.) / E-1736 (KS.) / LS 2019005467					
X-REF NO. 18109B					
DRAWING NO. 23-033P00P					
DATE MAY 10, 2023					
JOB NO. 23-003					
6	SHEET OF 13				



Elevation (feet)	Surf. Area (sq-ft)	Cum. Store (cubic-feet)
1014.10	52	0
1015	5,623	2,553
1016	10,269	10,499
1017	17,998	24,633
1018	20,048	43,657

Detention release was sized by Bentley PondPACK V8i and is sized to release the 100-year storm event over the proposed rip rap lined channel.

[illegible]

May 10, 2023



consult
Inc engineers planners

POST DEVELOPMENT
DRAINAGE AREA MAP

DOUGLAS CORNER BUILDING

LEE'S SUMMIT - JACKSON COUNTY - MISSOURI

<i>X-REF NO.</i>	18109B
<i>DRAWING NO.</i>	23-033PDP
<i>DATE</i>	MAY 10, 2023
<i>JOB NO.</i>	23-003

7 SHEET OF 13

IF THIS IS NOT A BLUE INK SEAL AND THE SIGNATURE IN BLUE INK, THE PLAN IS A COPY AND MAY CONTAIN UNAUTHORIZED ALTERATIONS. THE CERTIFICATION CONTAINED ON THIS DOCUMENT SHALL NOT APPLY TO ANY COPIES

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
84

CORPORATE LICENSE No. E201000573 (MO.) / E-1736 (KS.) / LS 20190005467

DOUGLAS

Project Summary

Title	DOUGLAS
Engineer	Kellen Huffman
Company	Hg Consult, Inc
Date	6/18/2018

Notes

DOUGLAS

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft ³ /s)
Area 1	Pre-Development Water Quality	1	0.245	11.930	4.48
Area 1	Post-Development Water Quality	1	0.292	11.930	5.45
Area 1	Pre-Development 2 year	2	1.146	11.920	21.51
Area 1	Post-Development 2 year	2	1.238	11.920	23.04
Area 1	Pre-Development 10 year	10	2.022	11.920	37.16
Area 1	Post-Development 10 year	10	2.131	11.920	38.69
Area 1	Pre-Development 100 year	100	3.233	11.920	57.94
Area 1	Post-Development 100 year	100	3.356	11.920	59.35

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft ³ /s)
Field Inlet	Pre-Development Water Quality	1	0.245	11.930	4.48
Field Inlet	Post-Development Water Quality	1	0.292	18.630	0.10
Field Inlet	Pre-Development 2 year	2	1.146	11.920	21.51
Field Inlet	Post-Development 2 year	2	1.233	12.240	3.13
Field Inlet	Pre-Development 10 year	10	2.022	11.920	37.16
Field Inlet	Post-Development 10 year	10	2.124	12.090	11.18
Field Inlet	Pre-Development 100 year	100	3.233	11.920	57.94
Field Inlet	Post-Development 100 year	100	3.346	12.100	15.28

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft ³ /s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
-------	----------	----------------------	---------------------------	----------------------	--------------------------------	--------------------------------------	------------------------------

DOUGLAS

Subsection: Master Network Summary

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft ³ /s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
Detention Pond (IN)	Post-Development Water Quality	1	0.292	11.930	5.45	(N/A)	(N/A)
Detention Pond (OUT)	Post-Development Water Quality	1	0.292	18.630	0.10	1,013.24	0.195
Detention Pond (IN)	Post-Development 2 year	2	1.238	11.920	23.04	(N/A)	(N/A)
Detention Pond (OUT)	Post-Development 2 year	2	1.233	12.240	3.13	1,014.51	0.641
Detention Pond (IN)	Post-Development 10 year	10	2.131	11.920	38.69	(N/A)	(N/A)
Detention Pond (OUT)	Post-Development 10 year	10	2.124	12.090	11.18	1,015.48	1.015
Detention Pond (IN)	Post-Development 100 year	100	3.356	11.920	59.35	(N/A)	(N/A)
Detention Pond (OUT)	Post-Development 100 year	100	3.346	12.100	15.28	1,016.74	1.545

DOUGLAS_SPILLWAY

Project Summary

Title	DOUGLAS_SPILLW AY
Engineer	Kellen Huffman
Company	Hg Consult, Inc
Date	6/18/2018

Notes

DOUGLAS_SPILLWAY

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft ³ /s)
Area 1	Post-Development 100 year	100	3.356	11.920	59.35

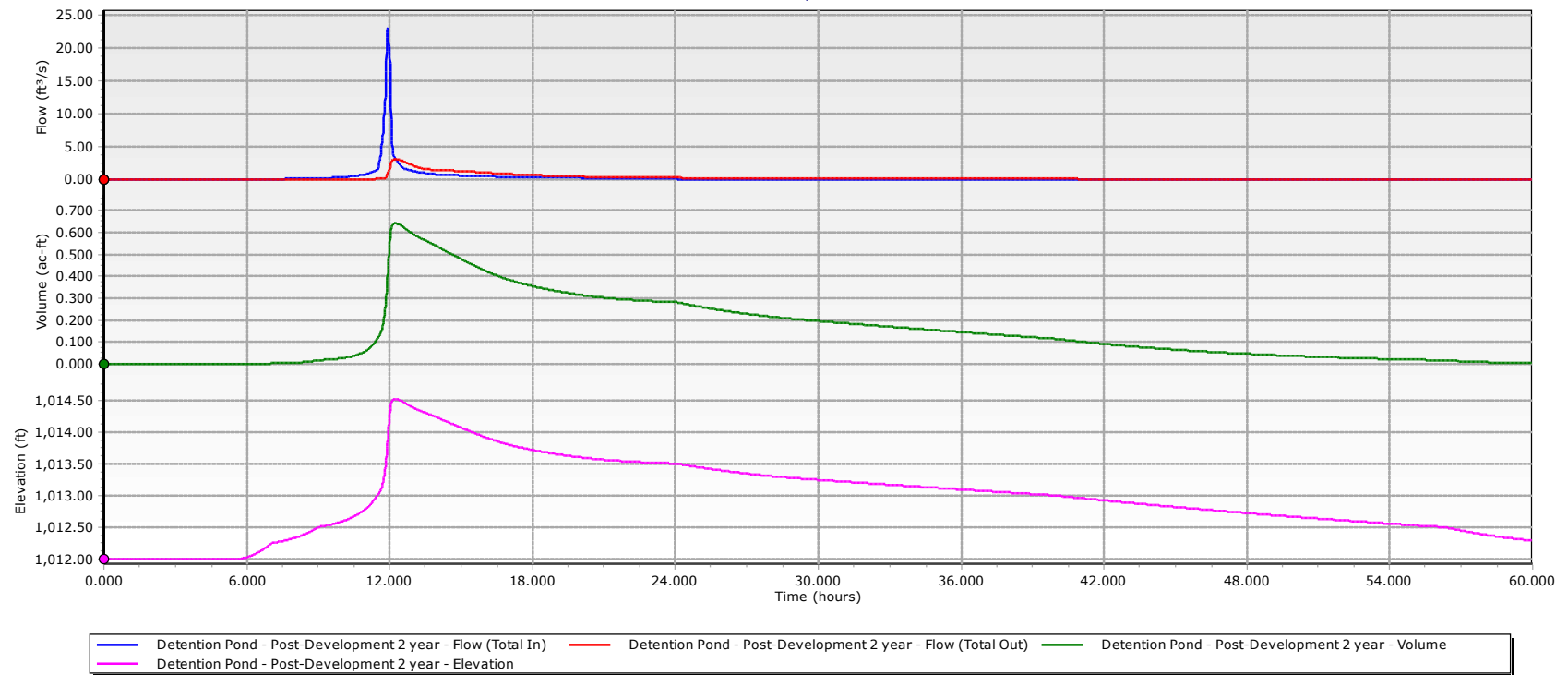
Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft ³ /s)
Field Inlet	Post-Development 100 year	100	3.127	11.960	51.94

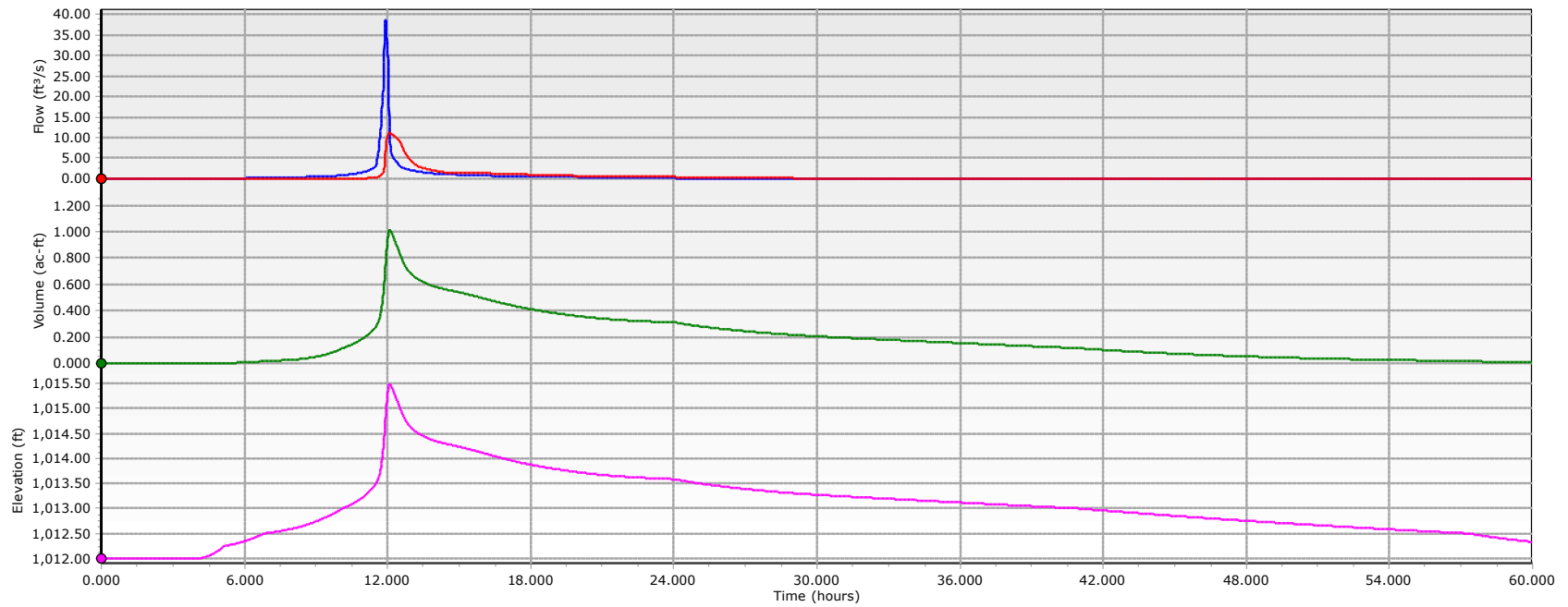
Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft ³ /s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
Detention Pond (IN)	Post-Development 100 year	100	3.356	11.920	59.35	(N/A)	(N/A)
Detention Pond (OUT)	Post-Development 100 year	100	3.127	11.960	51.94	1,017.93	2.092

New Graph

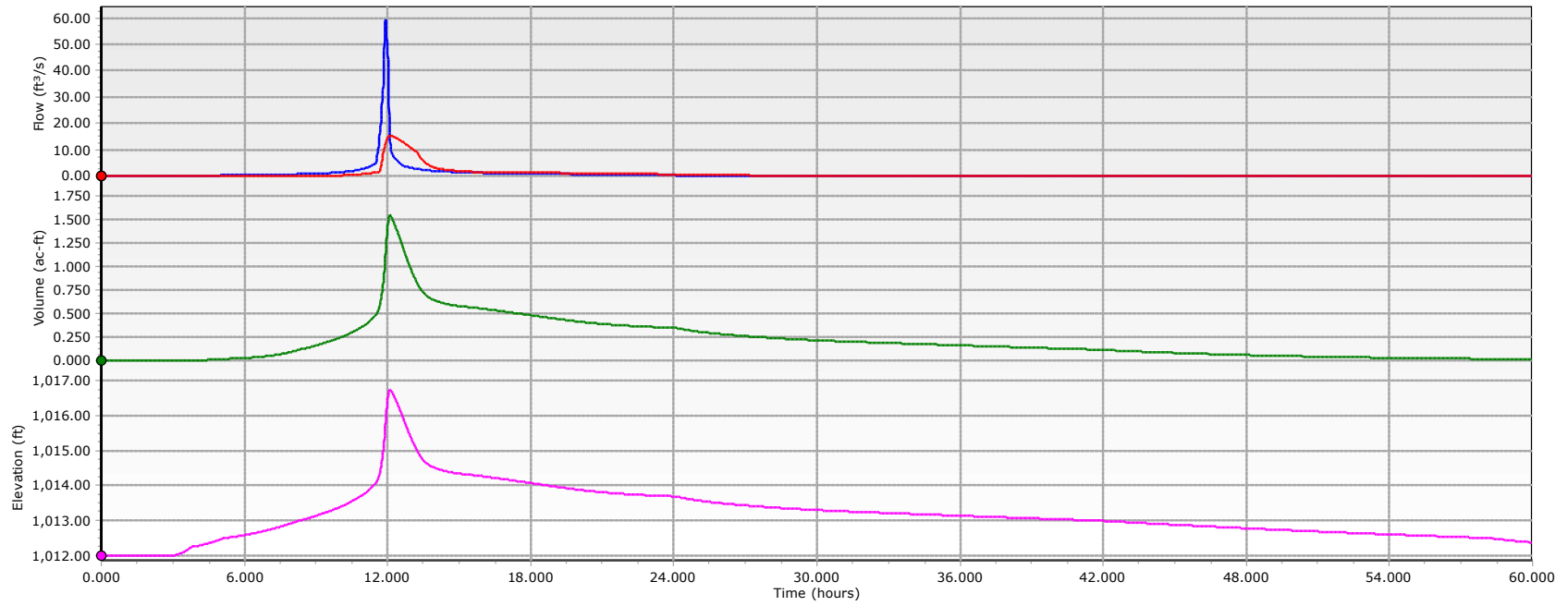


New Graph



Detention Pond - Post-Development 10 year - Flow (Total In)	Detention Pond - Post-Development 10 year - Flow (Total Out)
Detention Pond - Post-Development 10 year - Volume	Detention Pond - Post-Development 10 year - Elevation

New Graph



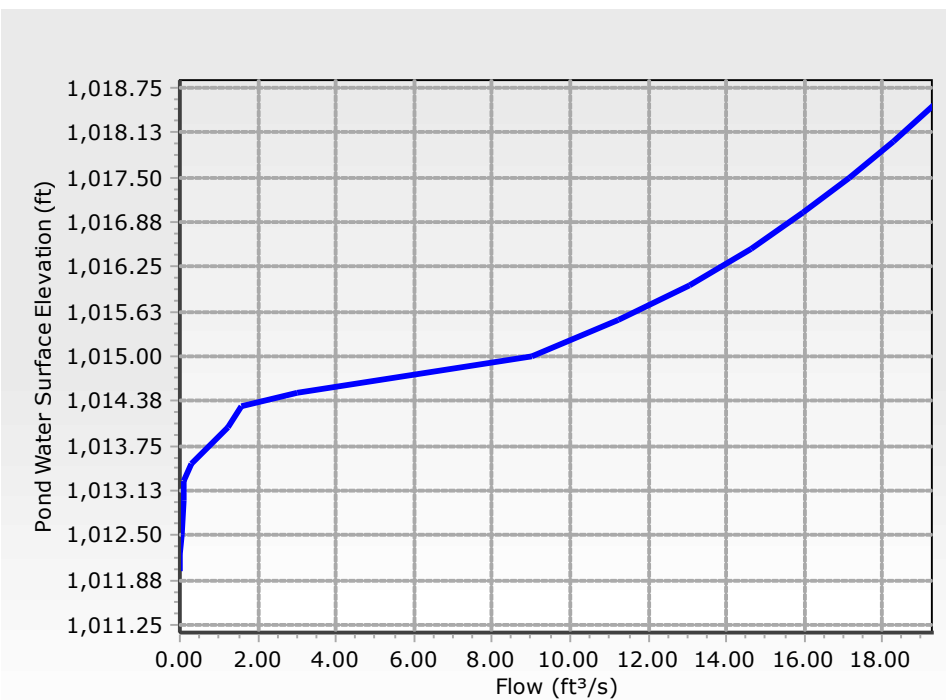
Detention Pond - Post-Development 100 year - Flow (Total In)	Detention Pond - Post-Development 100 year - Flow (Total Out)
Detention Pond - Post-Development 100 year - Volume	Detention Pond - Post-Development 100 year - Elevation

Composite Outlet Structure Detailed Report: Primary Outlet Structure

Element Details			
Label	Primary Outlet Structure	Notes	
Headwater Range			
Headwater Type	Use Pond for Headwater Range	Maximum (Headwater)	1,018.50 ft
Pond	Detention Pond	Increment (Headwater)	0.50 ft
Minimum (Headwater)	1,012.00 ft		
SpotElevation (ft)			
Tailwater Setup			
Tailwater Type	Free Outfall		
Tailwater Tolerances			
Maximum Iterations	30	Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft	Flow Tolerance (Minimum)	0.001 ft³/s
Headwater Tolerance (Maximum)	0.50 ft	Flow Tolerance (Maximum)	10.000 ft³/s
Tailwater Tolerance (Minimum)	0.01 ft		
Outlet Structure			
Outlet Structure Type	Culvert	Culvert Type	Circular
Outlet Structure (IDs and Direction)			
Outlet ID	Culvert - 1	Downstream ID	Tailwater
Flow Direction	Forward Flow Only	Notes	
Outlet Structure (Advanced)			
Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft
Culvert Data			
Number of Barrels	1	Downstream Invert	1,010.82 ft
Length	118.00 ft	Diameter	18.0 in
Upstream Invert	1,012.00 ft		
Unsubmerged->Submerged			
Specify Transitions	False	Compute Inlet Control Only	False

Composite Outlet Structure Detailed Report: Primary Outlet Structure

Culvert Coefficients			
Inlet Description	Concrete - Groove end projecting	C	0.0317
Chart	Chart 1	Y	0.6900
Nomograph	Nomograph 3	Manning's n	0.011
Equation Form	Form 1	Ke	0.200
K	0.0045	Kr	0.000
M	2.0000	Slope Correction Factor	-0.500
Culvert (Advanced)			
Convergence Tolerance	0.00 ft	Specify Number of Backwater Sections	False



RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Culvert - 1 (Culvert-Circular)

Mannings open channel maximum capacity: 13.35 ft³/s

Upstream ID = Orifice - 2, Orifice - 3, Riser - 1, Orifice - 1

Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
1,012.00	0.00	0.00	0.00	Free Outfall
1,012.25	0.02	1,012.07	Free Outfall	Free Outfall

Composite Outlet Structure Detailed Report: Primary Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Culvert - 1 (Culvert-Circular)

Mannings open channel maximum capacity: 13.35 ft³/s

Upstream ID = Orifice - 2, Orifice - 3, Riser - 1, Orifice - 1

Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Device Flow (ft ³ /s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
1,012.50	0.06	1,012.12	Free Outfall	Free Outfall
1,013.00	0.09	1,012.16	Free Outfall	Free Outfall
1,013.25	0.11	1,012.17	Free Outfall	Free Outfall
1,013.50	0.28	1,012.27	Free Outfall	Free Outfall
1,014.00	1.21	1,012.59	Free Outfall	Free Outfall
1,014.30	1.55	1,012.67	Free Outfall	Free Outfall
1,014.50	3.00	1,012.96	Free Outfall	Free Outfall
1,015.00	9.01	1,013.86	Free Outfall	Free Outfall
1,015.50	11.25	1,014.31	Free Outfall	Free Outfall
1,016.00	13.07	1,014.76	Free Outfall	Free Outfall
1,016.50	14.64	1,015.20	Free Outfall	Free Outfall
1,017.00	15.96	1,015.76	Free Outfall	Free Outfall
1,017.50	17.15	1,016.31	Free Outfall	Free Outfall
1,018.00	18.27	1,016.85	Free Outfall	Free Outfall
1,018.50	19.31	1,017.39	Free Outfall	Free Outfall
Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft ³ /s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.01	(N/A)	0.00	
0.00	0.01	(N/A)	0.00	
0.00	0.01	(N/A)	0.00	
0.00	0.01	(N/A)	0.00	
0.00	0.01	(N/A)	0.00	
0.00	0.01	(N/A)	0.00	
0.00	0.01	(N/A)	0.00	
0.00	0.01	(N/A)	0.00	

Message

WS below an invert; no flow.
CRIT.DEPTH CONTROL Vh= .018ft
Dcr= .053ft CRIT.DEPTH Hev= .00ft

Composite Outlet Structure Detailed Report: Primary Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Culvert - 1 (Culvert-Circular)

Mannings open channel maximum capacity: 13.35 ft³/s

Upstream ID = Orifice - 2, Orifice - 3, Riser - 1, Orifice - 1

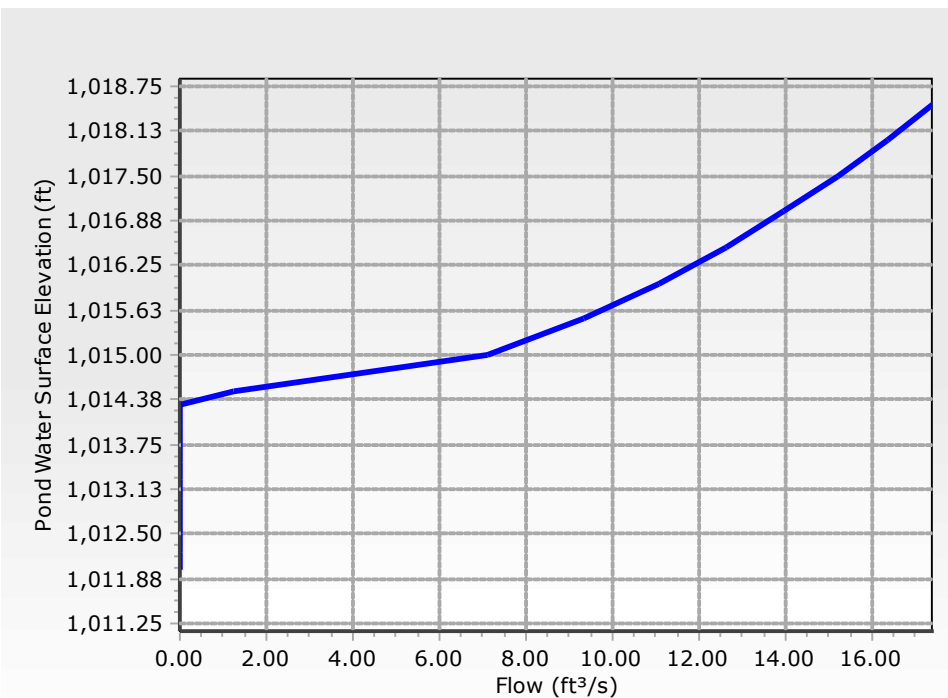
Downstream ID = Tailwater (Pond Outfall)

Message
CRIT.DEPTH CONTROL Vh= .029ft Dcr= .086ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .038ft Dcr= .111ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .040ft Dcr= .119ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .067ft Dcr= .194ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .147ft Dcr= .411ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .169ft Dcr= .468ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .251ft Dcr= .658ft CRIT.DEPTH Hev= .00ft
CRIT.DEPTH CONTROL Vh= .586ft Dcr= 1.162ft CRIT.DEPTH Hev= .00ft
INLET CONTROL... Submerged: HW =2.31
INLET CONTROL... Submerged: HW =2.76
INLET CONTROL... Submerged: HW =3.20
FULL FLOW...Lfull=112.82ft Vh=1.267ft HL=3.384ft Hev= .00ft
FULL FLOW...Lfull=115.54ft Vh=1.464ft HL=3.963ft Hev= .00ft
FULL FLOW...Lfull=116.79ft Vh=1.660ft HL=4.521ft Hev= .00ft
FULL FLOW...Lfull=117.01ft Vh=1.855ft HL=5.057ft Hev= .00ft

Outlet Structure			
Outlet Structure Type		Riser	
Outlet Structure (IDs and Direction)			
Outlet ID	Riser - 1	Downstream ID	Culvert - 1
Flow Direction	Forward Flow Only	Notes	
Outlet Structure (Advanced)			
Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft
Outlet Structure (Riser)			

Composite Outlet Structure Detailed Report: Primary Outlet Structure

Outlet Structure (Riser)			
Riser	Stand Pipe	Transition Elevation	0.00 ft
Diameter	18.0 in	Transition Height	0.00 ft
Weir Coefficient	3.00 (ft ^{0.5})/s	K Reverse	1.000
Orifice Coefficient	0.600		
Outlet Structure (Common)			
Elevation	1,014.30 ft		
Outlet Structure (Riser, Advanced)			
Use Orifice Depth to Crest?	True	Use Submerged Weir Equation?	False



RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Riser - 1 (Stand Pipe)

Upstream ID = (Pond Water Surface)

Downstream ID = Culvert - 1 (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
1,012.00	0.00	0.00	0.00	0.00
1,012.25	0.00	0.00	0.00	1,012.07
1,012.50	0.00	0.00	0.00	1,012.12

Composite Outlet Structure Detailed Report: Primary Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Riser - 1 (Stand Pipe)

Upstream ID = (Pond Water Surface)

Downstream ID = Culvert - 1 (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft ³ /s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
1,013.00	0.00	0.00	0.00	1,012.16
1,013.25	0.00	0.00	0.00	1,012.17
1,013.50	0.00	0.00	0.00	1,012.27
1,014.00	0.00	0.00	0.00	1,012.59
1,014.30	0.00	0.00	0.00	1,012.67
1,014.50	1.26	1,014.50	Free Outfall	1,012.96
1,015.00	7.12	1,015.00	Free Outfall	1,013.86
1,015.50	9.32	1,015.50	1,014.31	1,014.31
1,016.00	11.09	1,016.00	1,014.76	1,014.76
1,016.50	12.62	1,016.50	1,015.20	1,015.20
1,017.00	13.98	1,017.00	1,015.76	1,015.76
1,017.50	15.21	1,017.50	1,016.31	1,016.31
1,018.00	16.36	1,018.00	1,016.85	1,016.85
1,018.50	17.43	1,018.50	1,017.39	1,017.39
Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft ³ /s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	

Message

WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.

Composite Outlet Structure Detailed Report: Primary Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Riser - 1 (Stand Pipe)

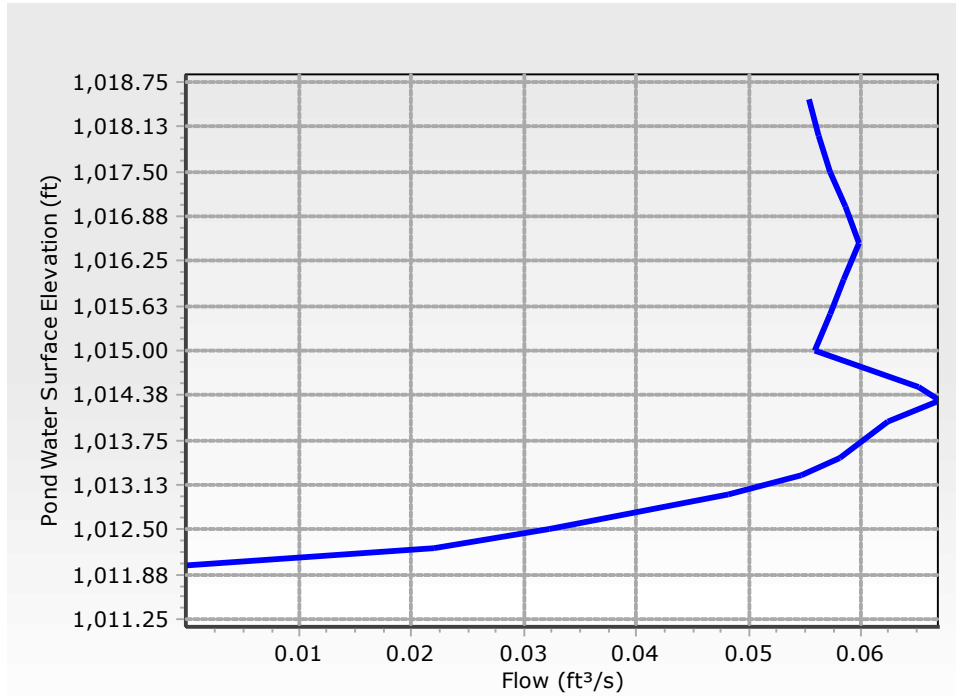
Upstream ID = (Pond Water Surface)

Downstream ID = Culvert - 1 (Culvert-Circular)

Message			
WS below an invert; no flow.			
WS below an invert; no flow.			
WS below an invert; no flow.			
Weir: H =0.2ft			
Orifice: H =.70; Riser orifice equation controlling.			
FULLY CHARGED RISER: Orifice Equation Control to Crest; H=1.20			
FULLY CHARGED RISER: Orifice Equation Control to Crest; H=1.70			
FULLY CHARGED RISER: Orifice Equation Control to Crest; H=2.20			
FULLY CHARGED RISER: Orifice Equation Control to Crest; H=2.70			
FULLY CHARGED RISER: Orifice Equation Control to Crest; H=3.20			
FULLY CHARGED RISER: Orifice Equation Control to Crest; H=3.70			
FULLY CHARGED RISER: Orifice Equation Control to Crest; H=4.20			

Outlet Structure			
Outlet Structure Type		Orifice	
Outlet Structure (IDs and Direction)			
Outlet ID	Orifice - 1	Downstream ID	Culvert - 1
Flow Direction	Forward Flow Only	Notes	
Outlet Structure (Advanced)			
Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft
Outlet Structure (Orifice)			
Orifice	Circular Orifice	Orifice Coefficient	0.600
Number of Openings	2	Orifice Diameter	1.0 in
Outlet Structure (Common)			
Elevation	1,012.00 ft		

Composite Outlet Structure Detailed Report: Primary Outlet Structure



RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Orifice - 1 (Orifice-Circular)

Upstream ID = (Pond Water Surface)

Downstream ID = Culvert - 1 (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
1,012.00	0.00	0.00	0.00	0.00
1,012.25	0.02	1,012.25	1,012.07	1,012.07
1,012.50	0.03	1,012.50	1,012.12	1,012.12
1,013.00	0.05	1,013.00	1,012.16	1,012.16
1,013.25	0.05	1,013.25	1,012.17	1,012.17
1,013.50	0.06	1,013.50	1,012.27	1,012.27
1,014.00	0.06	1,014.00	1,012.59	1,012.59
1,014.30	0.07	1,014.30	1,012.67	1,012.67
1,014.50	0.07	1,014.50	1,012.96	1,012.96
1,015.00	0.06	1,015.00	1,013.86	1,013.86
1,015.50	0.06	1,015.50	1,014.31	1,014.31
1,016.00	0.06	1,016.00	1,014.76	1,014.76
1,016.50	0.06	1,016.50	1,015.20	1,015.20
1,017.00	0.06	1,017.00	1,015.76	1,015.76
1,017.50	0.06	1,017.50	1,016.31	1,016.31
1,018.00	0.06	1,018.00	1,016.85	1,016.85
1,018.50	0.06	1,018.50	1,017.39	1,017.39

Composite Outlet Structure Detailed Report: Primary Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Orifice - 1 (Orifice-Circular)

Upstream ID = (Pond Water Surface)

Downstream ID = Culvert - 1 (Culvert-Circular)

Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft ³ /s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00

Message

WS below an invert; no flow.

H =.18
H =.38
H =.84
H =1.08
H =1.23
H =1.41
H =1.63
H =1.54
H =1.14
H =1.19
H =1.24
H =1.30
H =1.24
H =1.19
H =1.15
H =1.11

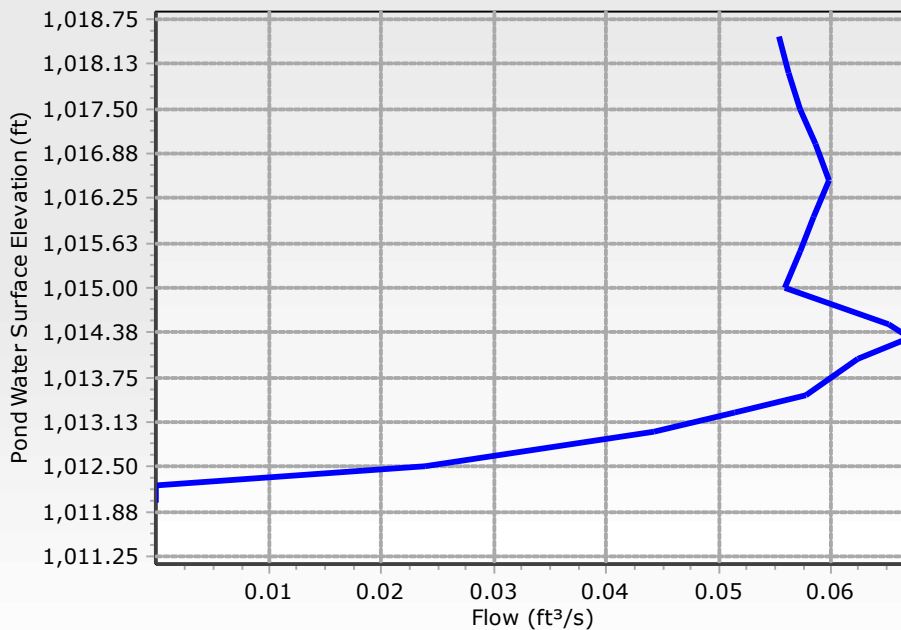
Outlet Structure

Outlet Structure Type Orifice

Outlet Structure (IDs and Direction)

Composite Outlet Structure Detailed Report: Primary Outlet Structure

Outlet Structure (IDs and Direction)			
Outlet ID	Orifice - 2	Downstream ID	Culvert - 1
Flow Direction	Forward Flow Only	Notes	
Outlet Structure (Advanced)			
Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft
Outlet Structure (Orifice)			
Orifice	Circular Orifice	Orifice Coefficient	0.600
Number of Openings	2	Orifice Diameter	1.0 in
Outlet Structure (Common)			
Elevation	1,012.25 ft		



RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Orifice - 2 (Orifice-Circular)

Upstream ID = (Pond Water Surface)

Downstream ID = Culvert - 1 (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
------------------------------	---------------------	--	---	---

Composite Outlet Structure Detailed Report: Primary Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Orifice - 2 (Orifice-Circular)

Upstream ID = (Pond Water Surface)

Downstream ID = Culvert - 1 (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft ³ /s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
1,012.00	0.00	0.00	0.00	0.00
1,012.25	0.00	0.00	0.00	1,012.07
1,012.50	0.02	1,012.50	Free Outfall	1,012.12
1,013.00	0.04	1,013.00	Free Outfall	1,012.16
1,013.25	0.05	1,013.25	Free Outfall	1,012.17
1,013.50	0.06	1,013.50	1,012.27	1,012.27
1,014.00	0.06	1,014.00	1,012.59	1,012.59
1,014.30	0.07	1,014.30	1,012.67	1,012.67
1,014.50	0.07	1,014.50	1,012.96	1,012.96
1,015.00	0.06	1,015.00	1,013.86	1,013.86
1,015.50	0.06	1,015.50	1,014.31	1,014.31
1,016.00	0.06	1,016.00	1,014.76	1,014.76
1,016.50	0.06	1,016.50	1,015.20	1,015.20
1,017.00	0.06	1,017.00	1,015.76	1,015.76
1,017.50	0.06	1,017.50	1,016.31	1,016.31
1,018.00	0.06	1,018.00	1,016.85	1,016.85
1,018.50	0.06	1,018.50	1,017.39	1,017.39
Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft ³ /s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	
0.00	0.00	(N/A)	0.00	

Message

WS below an invert; no flow.
WS below an invert; no flow.

Composite Outlet Structure Detailed Report: Primary Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE

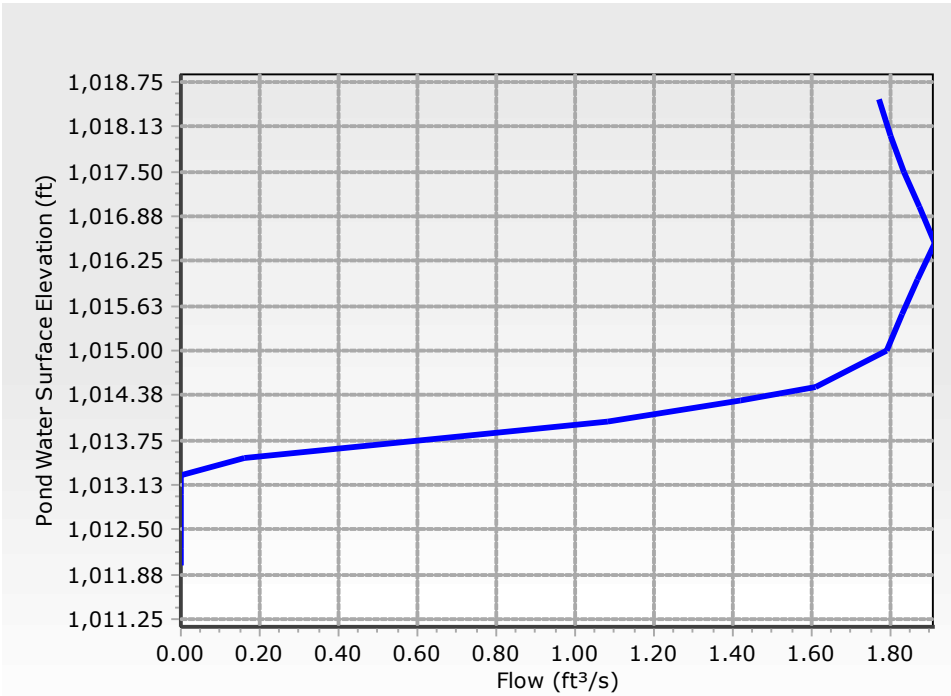
Structure ID = Orifice - 2 (Orifice-Circular)

Upstream ID = (Pond Water Surface)

Downstream ID = Culvert - 1 (Culvert-Circular)

Message			
H =.21 H =.71 H =.96 H =1.21 H =1.41 H =1.63 H =1.54 H =1.14 H =1.19 H =1.24 H =1.30 H =1.24 H =1.19 H =1.15 H =1.11			
Outlet Structure			
Outlet Structure Type		Orifice	
Outlet Structure (IDs and Direction)			
Outlet ID	Orifice - 3	Downstream ID	Culvert - 1
Flow Direction	Forward Flow Only	Notes	
Outlet Structure (Advanced)			
Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft
Outlet Structure (Orifice)			
Orifice	Circular Orifice	Orifice Coefficient	0.600
Number of Openings	1	Orifice Diameter	8.0 in
Outlet Structure (Common)			
Elevation	1,013.25 ft		

Composite Outlet Structure Detailed Report: Primary Outlet Structure



RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Orifice - 3 (Orifice-Circular)

Upstream ID = (Pond Water Surface)

Downstream ID = Culvert - 1 (Culvert-Circular)

Water Surface Elevation (ft)	Device Flow (ft³/s)	(into) Headwater Hydraulic Grade Line (ft)	Converge Downstream Hydraulic Grade Line (ft)	Next Downstream Hydraulic Grade Line (ft)
1,012.00	0.00	0.00	0.00	0.00
1,012.25	0.00	0.00	0.00	1,012.07
1,012.50	0.00	0.00	0.00	1,012.12
1,013.00	0.00	0.00	0.00	1,012.16
1,013.25	0.00	0.00	0.00	1,012.17
1,013.50	0.16	1,013.50	Free Outfall	1,012.27
1,014.00	1.08	1,014.00	Free Outfall	1,012.59
1,014.30	1.42	1,014.30	Free Outfall	1,012.67
1,014.50	1.61	1,014.50	Free Outfall	1,012.96
1,015.00	1.79	1,015.00	1,013.86	1,013.86
1,015.50	1.83	1,015.50	1,014.31	1,014.31
1,016.00	1.87	1,016.00	1,014.76	1,014.76
1,016.50	1.91	1,016.50	1,015.20	1,015.20
1,017.00	1.87	1,017.00	1,015.76	1,015.76
1,017.50	1.83	1,017.50	1,016.31	1,016.31
1,018.00	1.80	1,018.00	1,016.85	1,016.85
1,018.50	1.77	1,018.50	1,017.39	1,017.39

Composite Outlet Structure Detailed Report: Primary Outlet Structure

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Orifice - 3 (Orifice-Circular)

Upstream ID = (Pond Water Surface)

Downstream ID = Culvert - 1 (Culvert-Circular)

Downstream Hydraulic Grade Line Error (ft)	Convergence Error (ft ³ /s)	Downstream Channel Tailwater (ft)	Tailwater Error (ft)
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00
0.00	0.00	(N/A)	0.00

Message

WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 WS below an invert; no flow.
 CRIT.DEPTH CONTROL Vh= .066ft
 Dcr= .184ft CRIT.DEPTH Hev= .00ft
 H =.42
 H =.72
 H =.92
 H =1.14
 H =1.19
 H =1.24
 H =1.30
 H =1.24
 H =1.19
 H =1.15
 H =1.11

Composite Outlet Structure Detailed Report: Primary Outlet Structure

Composite Rating Table

Tailwater Elevation = Free Outfall (Primary Outlet Structure)

Water Surface Elevation (ft)	Flow (ft ³ /s)	Tailwater Elevation (ft)	Convergence Error (ft)
1,012.00	0.00	(N/A)	0.00
1,012.25	0.02	(N/A)	0.00
1,012.50	0.06	(N/A)	0.00
1,013.00	0.09	(N/A)	0.00
1,013.25	0.11	(N/A)	0.00
1,013.50	0.28	(N/A)	0.00
1,014.00	1.21	(N/A)	0.00
1,014.30	1.55	(N/A)	0.00
1,014.50	3.00	(N/A)	0.00
1,015.00	9.01	(N/A)	0.00
1,015.50	11.25	(N/A)	0.00
1,016.00	13.07	(N/A)	0.00
1,016.50	14.64	(N/A)	0.00
1,017.00	15.96	(N/A)	0.00
1,017.50	17.15	(N/A)	0.00
1,018.00	18.27	(N/A)	0.00
1,018.50	19.31	(N/A)	0.00

Contributing Structures

(no Q: Orifice - 2,Orifice
- 3,Riser - 1,Orifice -
1,Culvert - 1)
Orifice - 1,Culvert - 1
(no Q: Orifice - 2,Orifice -
3,Riser - 1)
Orifice - 2,Orifice -
1,Culvert - 1 (no Q:
Orifice - 3,Riser - 1)
Orifice - 2,Orifice -
1,Culvert - 1 (no Q:
Orifice - 3,Riser - 1)
Orifice - 2,Orifice -
1,Culvert - 1 (no Q:
Orifice - 3,Riser - 1)
Orifice - 2,Orifice -
3,Orifice - 1,Culvert - 1
(no Q: Riser - 1)
Orifice - 2,Orifice -
3,Orifice - 1,Culvert - 1
(no Q: Riser - 1)
Orifice - 2,Orifice -
3,Orifice - 1,Culvert - 1
(no Q: Riser - 1)
Orifice - 2,Orifice -
3,Riser - 1,Orifice -
1,Culvert - 1
Orifice - 2,Orifice -
3,Riser - 1,Orifice -
1,Culvert - 1

Composite Outlet Structure Detailed Report: Primary Outlet Structure

Composite Rating Table

Tailwater Elevation = Free Outfall (Primary Outlet Structure)

Contributing Structures

Orifice - 2, Orifice - 3, Riser - 1, Orifice - 1, Culvert - 1

Orifice - 2, Orifice - 3, Riser - 1, Orifice - 1, Culvert - 1

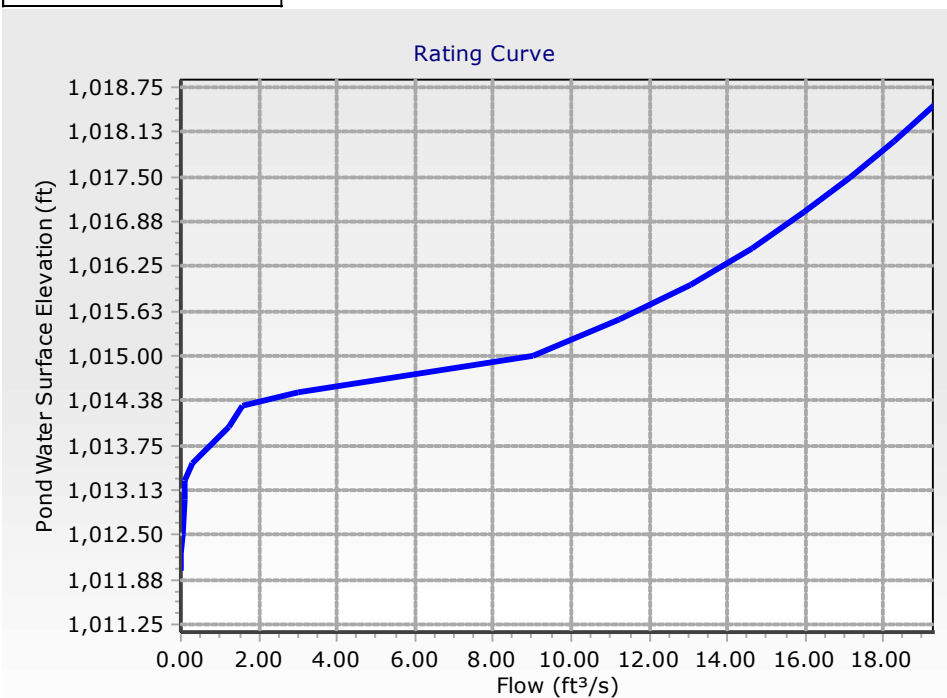
Orifice - 2, Orifice - 3, Riser - 1, Orifice - 1, Culvert - 1

Orifice - 2, Orifice - 3, Riser - 1, Orifice - 1, Culvert - 1

Orifice - 2, Orifice - 3, Riser - 1, Orifice - 1, Culvert - 1

Orifice - 2, Orifice - 3, Riser - 1, Orifice - 1, Culvert - 1

Orifice - 2, Orifice - 3, Riser - 1, Orifice - 1, Culvert - 1



Composite Outlet Structure Detailed Report: Emergency Spillway

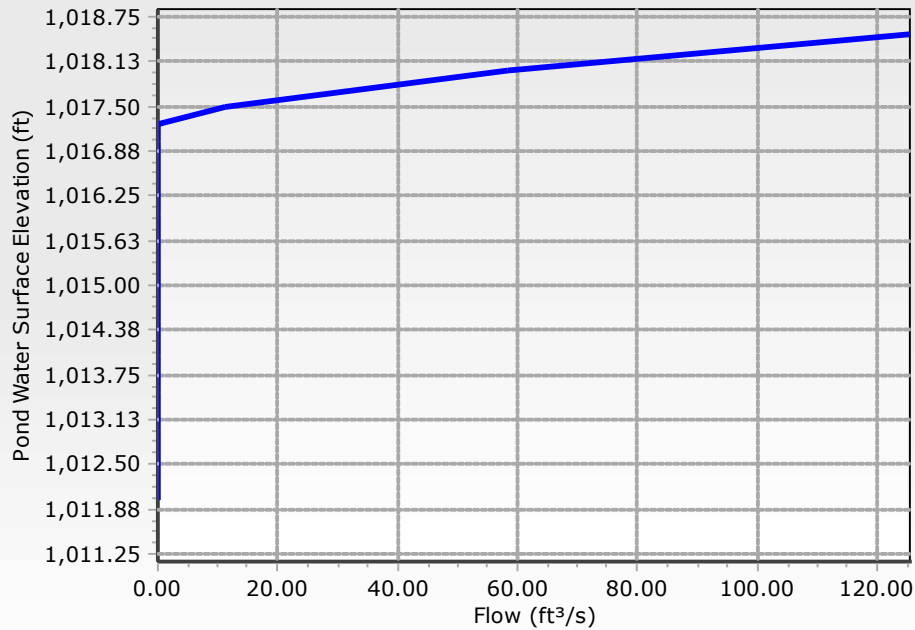
Element Details			
Label	Emergency Spillway	Notes	
Headwater Range			
Headwater Type	Use Pond for Headwater Range	Maximum (Headwater)	1,018.50 ft
Pond	Detention Pond	Increment (Headwater)	0.50 ft
Minimum (Headwater)	1,012.00 ft		
SpotElevation (ft)			
Tailwater Setup			
Tailwater Type	Free Outfall		
Tailwater Tolerances			
Maximum Iterations	30	Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft	Flow Tolerance (Minimum)	0.001 ft³/s
Headwater Tolerance (Maximum)	0.50 ft	Flow Tolerance (Maximum)	10.000 ft³/s
Tailwater Tolerance (Minimum)	0.01 ft		
Outlet Structure			
Outlet Structure Type	Weir		
Outlet Structure (IDs and Direction)			
Outlet ID	Weir	Downstream ID	Tailwater
Flow Direction	Forward Flow Only	Notes	
Outlet Structure (Advanced)			
Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft
Outlet Structure (Weir)			
Weir	Rectangular Weir	Rectangular Weir	Suppressed
Vary Coefficient with Depth	False	Weir Length	30.00 ft
Weir Coefficient	3.00 (ft^0.5)/s		
Outlet Structure (Common)			
Elevation	1,017.25 ft		

Composite Outlet Structure Detailed Report: Emergency Spillway

Outlet Structure (Weir, Advanced)

User Defined Table

False



RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Weir - 1 (Rectangular Weir)

Upstream ID = (Pond Water Surface)

Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)
1,012.00	0.00	(N/A)	0.00
1,012.50	0.00	(N/A)	0.00
1,013.00	0.00	(N/A)	0.00
1,013.50	0.00	(N/A)	0.00
1,014.00	0.00	(N/A)	0.00
1,014.50	0.00	(N/A)	0.00
1,015.00	0.00	(N/A)	0.00
1,015.50	0.00	(N/A)	0.00
1,016.00	0.00	(N/A)	0.00
1,016.50	0.00	(N/A)	0.00
1,017.00	0.00	(N/A)	0.00
1,017.25	0.00	(N/A)	0.00
1,017.50	11.25	(N/A)	0.00
1,018.00	58.46	(N/A)	0.00

Composite Outlet Structure Detailed Report: Emergency Spillway

RATING TABLE FOR ONE OUTLET TYPE

Structure ID = Weir - 1 (Rectangular Weir)

Upstream ID = (Pond Water Surface)

Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft ³ /s)	Tailwater Elevation (ft)	Convergence Error (ft)
1,018.50	125.78	(N/A)	0.00

Computation Messages

HW & TW below
 Inv.El.=1017.250
 HW & TW below
 Inv.El.=1017.250
 HW & TW below
 Inv.El.=1017.250
 HW & TW below
 Inv.El.=1017.250
 HW & TW below
 Inv.El.=1017.250
 HW & TW below
 Inv.El.=1017.250
 HW & TW below
 Inv.El.=1017.250
 HW & TW below
 Inv.El.=1017.250
 HW & TW below
 Inv.El.=1017.250
 HW & TW below
 Inv.El.=1017.250
 HW & TW below
 Inv.El.=1017.250
 H=.00; Htw=.00;
 Qfree=.00;
 H=.25; Htw=.00;
 Qfree=11.25;
 H=.75; Htw=.00;
 Qfree=58.46;
 H=1.25; Htw=.00;
 Qfree=125.78;

Composite Outlet Structure Detailed Report: Emergency Spillway

Composite Rating Table

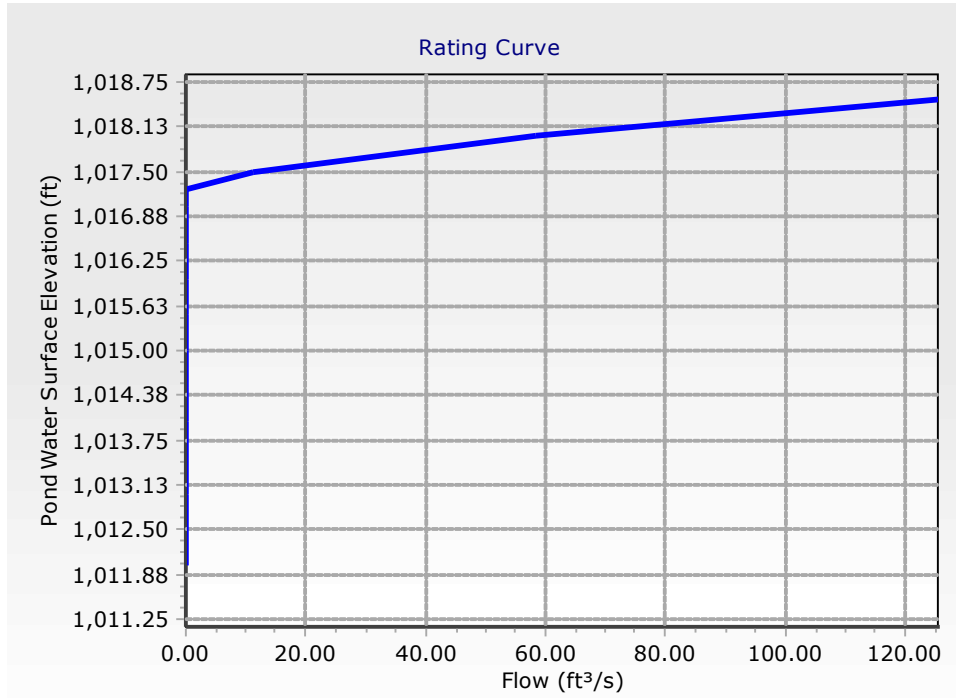
Tailwater Elevation = Free Outfall (Emergency Spillway)

Water Surface Elevation (ft)	Flow (ft ³ /s)	Tailwater Elevation (ft)	Convergence Error (ft)
1,012.00	0.00	(N/A)	0.00
1,012.50	0.00	(N/A)	0.00
1,013.00	0.00	(N/A)	0.00
1,013.50	0.00	(N/A)	0.00
1,014.00	0.00	(N/A)	0.00
1,014.50	0.00	(N/A)	0.00
1,015.00	0.00	(N/A)	0.00
1,015.50	0.00	(N/A)	0.00
1,016.00	0.00	(N/A)	0.00
1,016.50	0.00	(N/A)	0.00
1,017.00	0.00	(N/A)	0.00
1,017.25	0.00	(N/A)	0.00
1,017.50	11.25	(N/A)	0.00
1,018.00	58.46	(N/A)	0.00
1,018.50	125.78	(N/A)	0.00

Contributing Structures

None Contributing
None Contributing
None Contributing
None Contributing
None Contributing
None Contributing
None Contributing
None Contributing
None Contributing
None Contributing
Weir - 1
Weir - 1
Weir - 1
Weir - 1

Composite Outlet Structure Detailed Report: Emergency Spillway



Free Online Manning Pipe Flow Calculator

>> Drop your fears at the door; love is spoken here. <<

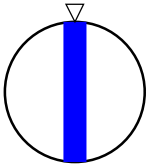
Manning Formula Uniform Pipe Flow at Given Slope and Depth

Can you help me translate, program, or host these calculators? (../contact.php) [Hide this request]

Check out our newest spreadsheet update: Download Spreadsheet (spreadsheet/Manning-Pipe-Flow.xlsx) Open Google Sheets version (spreadsheet/Manning-Pipe-Flow.php) View All Spreadsheets (http://www.hawsedc.com/engcalcs/SpreadsheetLibrary.php)

--CAUTION: If you have downloaded the spreadsheet prior to September 24, you may have received incorrect results!--

Douglas Corners		Results	
Detention Pond outlet stucture		Flow, Q	17.5547 cfs
Set units: m mm ft in		Velocity, v	9.9342 ft/sec
Pipe diameter, d_0	18 in	Velocity head, h_v	18.4056 in
Manning roughness, n ? (http://www.engineeringtoolbox.com/mannings-roughness-d_799.html)	0.011	Flow area	254.4695 sq. in.
Pressure slope (possibly ? (../pressureslope.php) equal to pipe slope), S_0	0.02 rise/run	Wetted perimeter	56.5487 in
Percent of (or ratio to) full depth (100% or 1 if flowing full)	1 fraction	Hydraulic radius	4.5000 in
		Top width, T	0.0000 in
		Froude number, F	0.00
		Shear stress (tractive force), tau	1.8731 psf



Please give us your valued words of suggestion or praise. Did this free calculator exceed your expectations in every way? (../contact.php) [Hide this request]

Home (<http://www.hawsedc.com/index.php>) | Support (<http://www.hawsedc.com/support.php>) | FreeSoftware (<http://www.hawsedc.com/gnu/index.php>) | Engineering Services (<http://www.hawsedc.com/engserv.php>) | Engineering Calculators (<http://www.hawsedc.com/engcalcs/index.php>) | Technical Documents (<http://www.hawsedc.com/techdocs.php>) | Blog (new in 2009) (<http://tomsthird.blogspot.com/>) | Personal essays (<http://www.hawsedc.com/thomas>) | Collaborative Family Trees (<http://www.hawsedc.com/famtree.php>) | Contact (<http://www.hawsedc.com/contact.php>)

14. The Time vs. Volume graph:
(See attached).

15. A discussion of all conclusions, including any waivers necessary to comply with the Design and Construction Manual.

All design is in compliance with the Design and Construction Manual. No variance requested.

16. Explanation of the accounting procedure used to calculate the allowable release rate at key points shown on the drainage maps. In essence, if off-site contributors to drainage area are present in the existing condition drainage area map, then a percentage of their existing peak flow rate can be added to the allowable peak flow rate to the various drainage points of discharge.

No off-site areas are included in this report.

17. A table showing how these drainage areas were accounted in the calculation of the allowable peak flow rate at the various drainage points of discharge.

All drainage areas discharge at the detention pond as shown and accounted for.

18. Final Report - Inflow hydrographs for the 2, 10, and 100 year storm events (please keep in mind that this information will be required to run the preliminary model, but not necessarily required in the preliminary report).

The 2, 10 and 100 year storm events are included in this report.

19. The maximum water surface elevation within the basin (normally the 100 year event).

The maximum water surface elevation within the basin are included in this report (1016.74).

20. Final Report: Stage-discharge-rating curves/data tables for each emergency spillway, primary outlet works and combined outlets and overflows.

Stage-storage rating curves included in Douglas Spillway Report.

21. Final Report: Routing curves for all design storms with time plotted as the abscissa, and the following plotted as ordinates:

- a. Cumulative inflow volume
- b. Cumulative discharge
- c. Stage elevation
- d. Cumulative storage

Routing curves to be submitted with Final Report as requested.